TABLES

FOR

~~533.g 14~~
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REDUCING LUNAR OBSERVATIONS,

AND

OBVIATING THE DIFFICULTIES

IN

FINDING THE LONGITUDE,

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INTRODUCTION.

WHEN the altitudes and distance between the moon and the sun or a star, are taken for the purpose of finding the Longitude at Sea, it is usual to have three instruments, with which three cotemporary observations are made; and it is also customary to have a fourth person to note the times by a watch.

The writers on the subject having recommended this as the best method of practising the lunar observations, it has been considered as a matter *absolutely necessary* by those less acquainted with it, and thereby occasioned the problem to *appear* of a more difficult and complex nature, than it really is. The Author of the following Tables, having been many years in the practice of observing, hath found very great convenience in adapting a mode of performing the whole with only one instrument, and without the use of a watch, whereby the danger of many errors is avoided:—The method alluded to is submitted to the judgement of those in the habits of making lunar observations, and recommended to such as are not yet proficient therein.

The first thing necessary to be attended to, is the error of the sextant used in making the observation, the quantity of which error should be previously determined by repeated measures of the sun's diameter, first on the arch as in common observations, and then backwards on the arc of excess, or to the right hand of the o. thus if forward on the instrument arch, the diameter is 31′ 15″, and backwards on the arc of excess, or to the right hand of o. it is 32′ 35″, the difference of these two measures is occasioned by the want of adjustment; for if it measures too little forwards, it will be too great backwards, consequently the difference being 1′ 20″, half of this quantity, or 40″, is the error of adjustment; and because, in this instance, the instrument measures two little by 40″—40″ must be added to all observations made with it; or it would be always subtractive if the greatest quantity was on the left hand of o.

As instruments will always be found to have some error to be allowed for, it is best to make them with the glasses fixt firm to the frame without any adjusting apparatus, and then the error will be a constant quantity, or its variation will be very trifling, which may arise from the effect of the expansion or contraction of the metal.

When the observer is assured of the quantity of the error, an arrangement should be formed of the observations intended to be made; for, by a proper order of observing, one person will perform all that is necessary. Five observations in the order of extreme and mean proportion, will be sufficient, which, in fair weather, may easily be made in the space of ten or twelve minutes, but the less time is employed the better. The arrangement may be thus:——

I. Altitude of the Moon.
II. Altitude of the Sun.
III. Distance of Sun and Moon.
IV. Altitude of the Sun.
V. Altitude of the Moon.

But it would be much better to make seven observations, three of which should be distances of sun and moon, all made in the middle, or in the following order:

Altitude of the Moon.
Distance of Sun and Moon.
Altitude of the Sun.
Distance of Sun and Moon.
Altitude of the Sun.
Distance of Sun and Moon.
Altitude of the Moon.

Or the distance may be first and last in the sett, and generally, in forming the sett, the two observations of the same object are at the same distance from the middle. The time employed in the seven observations, should not be more than eighteen or twenty minutes.

When the observations are made as above, it is to be understood that the whole time is about equally divided, and material errors in, that respect cannot happen when they are expertly taken. The three distances must be added together, and divided by three, which must be called the observed distance; the half of the two moon's altitude must be called the moon's observed altitude; and the half of the two sun's altitudes, the sun's observed altitude; the mean of the observations thus obtained, they are all to be corrected for the error of the sextant as above directed, and farther corrections must also be made by the preparatory rules hereafter given for reducing the observed to the apparent quantities. The apparent altitudes and distance are those to be used in finding the true distance, which, from the effects of parallax and refraction, is a problem of a difficult nature. Every one who has been in the habits of making and computing lunar observations at sea, have found the inconvenience of the length of the process, insomuch that many are deterred from attempting it, from the fear of committing errors in the calculation.

By the following Tables, the operation of finding the true distance is so concise, that the Author trusts no person in future will consider the Problem of the Longitude attended with any difficulty.

NECESSARY PREPARATIONS.

I. WRITE down the hour of the day at the time and place of obſervation, and under it the Longitude from Greenwich in time per account, and when the Longitude is West, add them together, otherwise subtract; the sum or difference will be the Greenwich time per estimation.

II. Seek in the Nautical Almanack on the given day, in page VIII. of the month, for the moon's semidiameter and horizontal parallax; if the estimate time is before noon, write them out for the last midnight and noon of the present day; but if it is afternoon, take them for noon and midnight of the present day, subtract them both, and say, if 12 hours give that difference, what will the estimate time since the last midnight or noon give; the seconds thus produced must be added to, or subtracted from the semidiameter and horizontal parallax first taken out according as they are increasing or decreasing; let these be reserved.

III. With the moon's altitude in degrees take the seconds of augmentation from Tab. IV. Requisite Tables, and add them to the semidiameter above found, which will be the true semidiameter at the time of observation. If the lower or nearest limbs are observed, the true semidiameter must be added to the observed altitude, otherwise subtracted.

IV. With the height of the eye above the surface of the water in feet, take the minutes and seconds of the dip of horizon from Tab. II. Requisite Tables, this must be subtracted from all altitudes taken in that part of the ship.

V. The altitudes corrected as above for sextant error, semidiameters, and dip, are called the apparent altitudes, and are those to be used with the apparent distance in finding the true distance.

VI. To the observed distance, apply the sextant error, as directed in the Introduction; and when the sun's distance from the moon is observed, the sun and moon's true semidiameters must also be added to the observed distance, because the moon's enlightened limb is always nearest to the sun; but when a star is used with the moon, the moon's semidiameter must be added to the observed distance when the star is on the enlightened side of moon, or subtracted when it is on the dark side, because the moon's center by reflection, is carried beyond the star in measuring the distance to her enlightened limb; this will give the apparent distance.

VII. With the star's altitude in degrees, take its refraction from Tab. I. Requisite Tables; or if the sun is observed, take the parallax also from Tab. III.—the refraction is the correction of the star's altitude, but the difference of the refraction and parallax is the correction of the sun's.

VIII. With the moon's apparent altitude and horizontal parallax above found, take its correction from Tab. VIII.

IX. Write the greatest apparent altitude, and under it the least, and subtract; this will be the difference of apparent altitudes; against each altitude place its respective correction found by the 7th and 8th articles, add them together, and divide by 2; place the half sum of corrections under the difference of apparent altitudes, and if the moon's altitude is greatest, add it thereto, otherwise subtract it. Call this sum or difference argument 4th.

X. In the same line with the first altitude, write also the apparent distance, and the moon's horizontal parallax.

XI. Prepare two columns as below, to receive the logarithms from the Tables.

1		4	
2		2	
3		5	

TABLE I.

MOON'S ALT.		54′	55′	56′	57′	58′	59′	60′	61′
°	′								
5	0	1.61	1.63	1.64	1.65	1.66	1.67	1.69	1.70
	20	.65	.66	.68	.69	.70	.71	.72	.73
	40	.69	.70	.71	.73	.74	.75	.76	.77
6	0	.72	.73	.75	.76	.77	.78	.79	.80
	20	.75	.77	.78	.79	.80	.81	.82	.83
	40	.78	.80	.81	.81	.83	.84	.85	.86
7	0	.81	.82	.83	.84	.85	.87	.88	.89
	20	.84	.85	.86	.87	.88	.89	.90	.91
	40	.86	.87	.88	.89	.90	.91	.92	.93
8	0	.88	.89	.90	.91	.93	.94	.95	.95
	20	.91	.92	.93	.94	.95	.96	.97	.98
	40	.93	.94	.95	.96	.97	.98	.99	2.01
9	0	.95	.96	.97	.98	.99	2.00	2.01	.02
	20	.96	.98	.99	2.00	2.01	.01	.02	.03
	40	.98	.99	2.00	.01	.04	.03	.04	.05
10	0	2.00	2.01	.02	.03	.07	.05	.06	.07
	30	.03	.04	.05	.06	.07	.08	.09	.09
11	0	.05	.06	.07	.08	.09	.10	.11	.11
	30	.07	.08	.09	.10	.11	.12	.13	.14
12	0	.09	.10	.11	.12	.13	.14	.15	.16
	30	.11	.12	.13	.14	.15	.16	.17	.18
13	0	.13	.14	.15	.16	.17	.18	.19	.19
	30	.15	.16	.17	.18	.19	.20	.21	.21
14	0	.17	.18	.19	.19	.20	.21	.22	.23
	30	.19	.20	.21	.21	.22	.23	.24	.25
15	0	.20	.21	.22	.23	.24	.24	.25	.26
	30	.22	.23	.24	.25	.26	.26	.27	.28
16	0	.23	.24	.25	.26	.27	.27	.28	.29
	30	.25	.26	.27	.28	.28	.29	.30	.31
17	0	.26	.27	.28	.29	.29	.30	.31	.32
	30	.27	.28	.29	.30	.31	.32	.33	.33
18	0	.28	.30	.30	.31	.32	.33	.34	.34
	30	.30	.31	.32	.33	.33	.34	.35	.36
19	0	.31	.32	.33	.34	.34	.35	.36	.37
	30	.32	.33	.34	.35	.36	.37	.37	.38
20	0	.33	.34	.35	.36	.37	.38	.38	.39
21		.36	.36	.37	.38	.40	.40	.41	.41
22		.37	.38	.39	.40	.41	.42	.43	.43
23		.40	.40	.42	.42	.43	.44	.45	.45
24		.41	.42	.43	.44	.45	.46	.46	.47
5		.43	.44	.45	.46	.47	.47	.48	.49

MOON'S ALT.	54′	55′	56′	57′	58′	59′	60′	61′
°								
26	2.46	2.46	2.47	2.47	2.48	2.49	2.50	2.51
27	.46	.47	.48	.49	.50	.51	.51	.52
28	.48	.49	.50	.51	.51	.52	.53	.54
29	.49	.50	.51	.52	.53	.54	.54	.55
30	.51	.52	.53	.53	.54	.55	.56	.57
31	.52	.53	.54	.55	.56	.56	.57	.58
32	.54	.54	.55	.56	.57	.58	.59	.59
33	.55	.56	.57	.57	.58	.59	.60	.60
34	.56	.57	.58	.59	.59	.60	.61	.62
35	.57	.58	.59	.60	.61	.61	.62	.63
36	.58	.59	.60	.61	.62	.62	.63	.64
37	.59	.60	.61	.62	.63	.64	.64	.65
38	.60	.61	.62	.63	.64	.65	.65	.66
39	.61	.62	.63	.64	.65	.66	.66	.67
40	.62	.63	.64	.65	.66	.66	.67	.68
41	.63	.64	.65	.66	.67	.67	.68	.69
42	.64	.65	.66	.67	.67	.68	.69	.70
43	.65	.66	.67	.68	.69	.69	.70	.71
44	.66	.67	.68	.68	.69	.70	.71	.72
45	.67	.68	.68	.69	.70	.71	.72	.72
46	.67	.68	.69	.70	.71	.72	.72	.73
47	.68	.69	.70	.71	.71	.72	.73	.74
48	.69	.70	.71	.71	.72	.73	.74	.75
50	.70	.71	.72	.73	.74	.74	.75	.76
52	.71	.72	.72	.74	.75	.76	.76	.77
54	.73	.74	.74	.75	.76	.77	.78	.78
56	.74	.75	.76	.76	.77	.78	.79	.79
58	.75	.76	.77	.77	.78	.79	.80	.80
60	.76	.77	.77	.78	.79	.80	.81	.81
62	.77	.78	.78	.79	.80	.81	.82	.82
64	.77	.78	.79	.80	.81	.82	.82	.83
66	.78	.79	.80	.81	.81	.82	.83	.84
68	.79	.80	.81	.81	.82	.83	.84	.84
70	.79	.80	.81	.82	.83	.83	.84	.85
72	.80	.81	.82	.82	.83	.84	.85	.86
74	.80	.81	.82	.83	.84	.85	.85	.86
76	.81	.82	.83	.83	.84	.85	.86	.86
78	.81	.82	.83	.84	.84	.85	.86	.87
80	.82	.82	.83	.84	.85	.86	.86	.87
90	.82	.83	.84	.85	.86	.86	.87	.88

2

TAB. II.				TAB. III. PART I.					TAB. III. PART II.			
Deg.	Log.	Deg.	Log.	°	No.	°	No.	No.	No.	Log.	No.	Log.
° '		°										
0 30	1.60	36	9.77	0	100	57	55	123	10	8 36	55	9 10
1 0	1.30	37	.76	6	99	58	53	122	11	.41	56	.11
30	1.12	38	.75	11	98	59	52	121	12	.44	57	.12
2 0	0.99	39	.74	13	97	60	50	120	13	.48	58	.13
30	.90	40	.73	16	96	61	49	119	14	.51	59	.13
3 0	.81	41	.72	18	95	62	47	118	15	.54	60	.14
30	.75	42	.71	21	93	63	45	117	16	.57	61	.15
4 0	.69	43	.70	23	92	64	44	116	17	.60	62	.16
30	.64	44	.69	24	91	65	42	115	18	.62	63	.16
5 0	.61	45	.69	26	90	66	41	114	19	.64	64	.17
30	.56	46	.68	27	89	67	39	113	20	.66	65	.17
6 0	.52	47	.67	28	88	68	38	112	21	69	66	.18
30	.48	48	.66	29	87	69	36	111	22	.71	67	.19
7 0	.45	49	66	30	87	70	34	110	23	.73	68	.19
30	.42	50	.65	31	86	71	33	109	24	.74	69	.20
8 0	.39	51	.65	32	85	72	31	108	25	.76	70	.21
30	.36	52	.64	33	84	73	29	107	26	.78	71	.21
9 0	.34	53	.63	34	83	74	28	106	27	.79	72	.22
30	.32	54	.63	35	82	75	26	105	28	.81	73	.23
10 0	.30	55	.62	36	81	76	24	104	29	.82	74	.23
11	.26	56	.62	37	80	77	23	103	30	.84	75	.24
12	.22	57	.61	38	79	78	21	102	31	.85	76	.24
13	.18	58	.61	39	78	79	19	101	32	.87	77	.25
14	.15	59	.60	40	77	80	17	100	33	.88	78	.26
15	.12	60	.60	41	76	81	16	99	34	.89	79	.26
16	.10	62	.59	42	74	82	14	98	35	.91	80	.27
17	.07	64	.58	43	73	83	12	97	36	.92	81	.27
18	.05	66	.58	44	72	84	11	96	37	.93	82	.28
19	.02	68	.57	45	71	85	9	95	38	.94	83	.28
20	0.00	70	.56	46	70	86	7	94	39	.95	84	.29
21	9.98	75	.55	47	68	87	5	93	40	.97	85	.29
22	.96	80	.54	48	67	88	4	92	41	.97	86	.30
23	.95	85	.54	49	66	89	2	91	42	.99	87	.31
24	.93	90	.54	50	64	90	0	90	43	9.00	88	.31
25	.91	95	.54	51	63	—	—	—	44	.00	89	.31
26	.90	100	.54	52	62				45	.02	90	.32
27	.88	105	.55	53	60				46	.03	91	.32
28	.87	110	.56	54	59				47	.04	92	.33
29	.85	115	.58	55	57				48	.05	93	.33
30	.84	120	.60	56	56				49	.05	94	.34
31	.83	—	—	—	—				50	.06	95	.34
32	.81								51	.07	96	.35
33	.80								52	.08	97	.35
34	.79								53	.09	98	.36
35	.78								54	.10	99	.36

TABLE IV.

	0	1	2	3	4	5	6	7	8	9	
	0	6″	12″	18″	24″	30″	36″	42″	48″	54″	
′	0	0.″6	1.″2	1.″8	2.″4	3. 0	3.″6	4.″2	4.″8	5.″4	′ ″
10	00	00	01	01	02	02	03	03	03	04	1 0
11	04	05	05	05	06	06	06	07	07	08	6
12	08	08	09	09	09	10	10	10	10	11	12
13	11	12	12	12	13	13	13	14	14	14	18
14	15	15	15	16	16	16	16	17	17	17	24
15	18	18	18	18	19	19	19	20	20	20	30
16	20	21	21	21	21	22	22	22	23	23	36
17	23	23	24	24	24	24	25	25	25	25	42
18	26	26	26	26	26	27	27	27	27	28	48
19	28	28	28	29	29	29	29	29	30	30	54
20	30	30	31	31	31	31	31	32	32	32	2 0
21	32	32	33	33	33	33	33	34	34	34	6
22	34	34	35	35	35	35	35	36	36	36	12
23	36	36	37	37	37	37	37	37	38	38	18
24	38	38	38	39	39	39	39	39	39	40	24
25	40	40	40	40	40	41	41	41	41	41	30
26	42	42	42	42	42	42	42	43	43	43	36
27	43	43	44	44	44	44	44	44	44	45	42
28	45	45	45	45	45	45	46	46	46	46	48
29	46	46	47	47	47	47	47	47	47	48	54
30	48	48	48	48	48	48	49	49	49	49	3 0
31	49	49	49	50	50	50	50	50	50	50	6
32	51	51	51	51	51	51	51	51	52	52	12
33	52	52	52	52	52	53	53	53	53	53	18
34	53	53	53	54	54	54	54	54	54	54	24
35	54	55	55	55	55	55	55	55	55	56	30
36	56	56	56	56	56	56	56	56	57	57	36
37	57	57	57	57	57	57	58	58	58	58	42
38	58	58	58	58	58	59	59	59	59	59	48
39	59	59	59	59	60	60	60	60	60	60	54
40	60	60	60	61	61	61	61	61	61	61	4 0
41	61	61	61	62	62	62	62	62	62	62	6
42	62	62	63	63	63	63	63	63	63	63	12
43	63	63	64	64	64	64	64	64	64	64	18
44	64	64	65	65	65	65	65	65	65	65	24
45	65	65	66	66	66	66	66	66	66	66	30
46	66	66	66	67	67	67	67	67	67	67	36
47	67	67	67	67	68	68	68	68	68	68	42
48	68	68	68	68	68	69	69	69	69	69	48
49	69	69	69	69	69	69	70	70	70	70	54

TABLE IV.

	0	1	2	3	4	5	6	7	8	9		
	0	6″	12″	18″	24″	30″	36″	42″	48″	54″		
′	0	0.″6	1.″2	1.″8	2.″4	3.″0	3.″6	4.″2	4.″8	5.″4	′	″
50	70	70	70	70	70	70	70	71	71	71	5	0
51	71	71	71	71	71	71	71	71	71	72		6
52	72	72	72	72	72	72	72	72	72	72		12
53	72	73	73	73	73	73	73	73	73	73		18
54	73	73	73	73	74	74	74	74	74	74		24
55	74	74	74	74	74	74	75	75	75	75		30
56	75	75	75	75	75	75	75	75	75	76		36
57	76	76	76	76	76	76	76	76	76	76		42
58	76	76	76	77	77	77	77	77	77	77		48
59	77	77	77	77	77	77	77	77	78	78		54
60	78	78	78	78	78	78	78	78	78	78	6	0
61	79	79	79	79	79	79	79	79	79	79		6
62	79	79	79	79	80	80	80	80	80	80		12
63	80	80	80	80	80	80	80	80	80	81		18
64	81	81	81	81	81	81	81	81	81	81		24
65	81	81	81	81	82	82	82	82	82	82		30
66	82	82	82	82	82	82	82	82	82	83		36
67	83	83	83	83	83	83	83	83	83	83		42
68	83	83	83	83	84	84	84	84	84	84		48
69	84	84	84	84	84	84	84	84	84	84		54
70	85	85	85	85	85	85	85	85	85	85	7	0
71	85	85	85	85	85	85	85	86	86	86		6
72	86	86	86	86	86	86	86	86	86	86		12
73	86	86	86	87	87	87	87	87	87	87		18
74	87	87	87	87	87	87	87	87	87	87		24
75	88	88	88	88	88	88	88	88	88	88		30
76	88	88	88	88	88	88	88	88	89	89		36
77	89	89	89	89	89	89	89	89	89	89		42
78	89	89	89	89	89	89	90	90	90	90		48
79	90	90	90	90	90	90	90	90	90	90		54
80	90	90	90	90	91	91	91	91	91	91	8	0
81	91	91	91	91	91	91	91	91	91	91		6
82	91	91	91	92	92	92	92	92	92	92		12
83	92	92	92	92	92	92	92	92	92	92		18
84	92	92	93	93	93	93	93	93	93	93		24
85	93	93	93	93	93	93	93	93	93	93		30
86	93	94	94	94	94	94	94	94	94	94		36
87	94	94	94	94	94	94	94	94	94	94		42
88	94	95	95	95	95	95	95	95	95	95		48
89	95	95	95	95	95	95	95	95	95	95		54

TABLE I. *Argument Moon's Apparent Altitude & Hor. Pax.* | *Dif. in Alt.* | **HP.**

MOON'S ALT.		54′	55′	56	57′	58′	59′	60′	61′	5′	10′	15′
5	0	1 6117	1 6253	1 6385	1 6503	1 6628	1 6749	1 6866	1 6981	98	196	293
	20	.6514	.6645	.6777	.6894	.7015	.7122	.7236	.7347	86	172	257
	40	.6884	.7010	.7137	.7253	.7370	.7473	.7584	.7691	82	165	246
6	0	.7226	.7348	.7466	.7582	.7694	.7803	.7910	.8014	74	147	221
	20	.7540	.7661	.7776	.7889	.7998	.8105	.8210	.8314	72	144	215
	40	.7834	.7954	.8066	.8176	2 8282	.8387	.8490	.8594	67	135	202
7	0	.8109	.8228	.8338	.8445	.8549	.8651	.8751	.8854	62	125	187
	20	.8365	.8480	.8588	.8694	.8798	.8900	.9000	.9099	59	117	176
	40	.8608	.8719	.8825	.8929	.9033	.9135	.9223	.9334	55	110	165
8	0	.8837	.8943	.9047	.9149	.9253	.9355	.9455	.9547	55	108	162
	20	.9053	.9159	.9262	.9364	.9467	.9567	.9655	.9756	57	102	153
	40	.9261	.9367	.9466	.9568	.9670	.9768	.9854	.9956	50	100	150
9	0	.9460	.9566	.9666	.9768	.9868	.9965	2 0060	2.0154	46	93	139
	20	.9647	.9752	.9852	.9954	2 0053	2 0149	.0243	.0336	45	89	134
	40	.9827	.9931	2 0031	2 0133	.0131	.0326	.0419	.0511	42	85	127
10	0	2.0000	2 0103	.0204	.0302	.0398	.0492	.0584	.0674	40	82	122
	20	.0169	.0271	.0371	.0468	.0563	.0657	.0748	.0837	38	80	118
	40	.0331	.0433	.0532	.0628	.0722	.0816	.0906	.0994	40	80	120
11	0	.0484	.0584	.0682	.0777	.0871	.0966	.1055	.1143	40	80	120
	20	.0639	.0738	.0835	.0931	.1023	.1116	.1206	.1293	38	79	117
	40	.0783	.0881	.0987	.1084	.1174	.1265	.1356	.1443	38	79	117
12	0	.0917	.1014	.1109	.1206	.1294	.1383	.1474	.1559	38	79	117
	20	.1048	.1145	.1240	.1335	.1423	.1513	.1603	.1688	30	60	90
	40	.1177	.1274	.1369	.1464	.1552	.1643	.1732	.1819	30	60	90
13	0	.1303	.1399	.1495	.1587	.1676	.1767	.1855	.1940	30	60	90
	20	.1423	.1520	.1615	.1706	.1795	.1885	.1972	.2056	30	60	90
	40	.1544	.1640	.1735	.1826	.1914	.2003	.2089	.2174	30	60	90
14	0	.1664	.1761	.1855	.1945	.2033	.2119	.2206	.2292	30	60	90
	20	.1774	.1871	.1965	.2055	.2143	.2229	.2314	.2400	30	60	90
	40	.1885	.1980	.2074	.2164	.2253	.2338	.2422	.2508	25	50	75
15	0	.1995	.2090	.2185	.2274	.2363	.2448	.2531	.2615	25	50	75
	20	.2098	.2191	.2284	.2374	.2463	.2547	.2641	.2715	25	50	75
	40	.2199	.2292	.2384	.2474	.2562	.2646	.2731	.2814	25	50	75
16	0	.2299	.2393	.2485	.2574	.2662	.2746	.2831	.2914	25	50	75
	20	.2393	.2487	.2579	.2667	.2755	.2839	.2923	.3006	25	50	75
	40	.2487	.2584	.2672	.2760	.2848	.2931	.3015	.3098	22	44	66
17	0	.2582	.2674	.2765	.2853	.2940	.3023	.3107	.3189	23	46	69
	20	.2670	.2762	.2852	.2940	.3026	.3109	.3193	.3274	22	43	65
	40	.2758	.2850	.2939	.3037	.3112	.3195	.3279	.3361			
18	0	.2847	.2938	.3025	.3113	.3199	.3284	.3367	.3448			
	20	.2930	.3021	.3108	.3196	.3281	.3366	.3449	.3530	21	42	63
	40	.3013	.3104	.3191	.3279	.3364	.3448	.3534	.3612			
19	0	.3096	.3187	.3274	.3361	.3446	.3530	.3616	.3694	21	41	62
	20	.3173	.3264	.3351	.3438	.3523	.3607	.3692	.3771			
	40	.3250	.3341	.3428	.3515	.3600	.3684	.3768	.3848	19	39	58
20	0	.3326	.3418	.3506	.3593	.3677	.3760	.3844	.3925			
	20	.3399	.3491	.3583	.3670	.3754	.3837	.3921	.4002			
	40	.3476	.3567	.3654	.3732	.3826	.3908	.3991	.4072	18	36	55
21	0	.3551	.3640	.3727	.3815	.3899	.3981	.4064	.4145			
	20	.3621	.3710	.3797	.3885	.3969	.4051	.4134	.4215			
	40	.3691	.3780	.3867	.3955	.4039	.4121	.4204	.4285	18	35	53
22	0	.3746	.3838	.3926	.4013	.4097	.4179	.4259	.4338			
	20	.3813	.3904	.3993	.4080	.4164	.4246	.4326	.4405			
	40	.3881	.3970	.4060	.4148	.4230	.4313	.4393	.4472	17	34	51

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TABLE I. *Argument Moon's Apparent Altitude & Hor. Pax.*

MOON'S ALT.		54'	55'	56'	57'	58'	59'	60'	61'	*Dif. in Alt.*			HP.	
										5'	10'	15'	"	
23	0	1 3952	1 4040	1 4128	1 4214	1 4296	1 4379	1 4459	1 4538					
	20	.4015	.4103	.4191	.4277	.4359	.4442	.4522	.4600					
	40	.4077	.4165	.4253	.4338	.4421	.4504	.4583	.4662				5	7
24	0	.4138	.4227	.4314	.4398	.4482	.4564	.4643	.4725	15	30	45	10	14
	20	.4198	.4287	.4374	.4458	.4541	.4623	.4703	.4784				15	21
	40	.4258	.4347	.4434	.4517	.4601	.4682	.4762	.4842	15	29	44	20	28
25	0	.4318	.4406	.4494	.4577	.4660	.4742	.4822	.4900				25	35
	20	.4375	.4453	.4551	.4634	.4717	.4799	.4879	.4957				30	41
	40	.4431	.4519	.4606	.4690	.4773	.4855	.4935	.5013	14	28	41	35	48
													40	56
26	0	2 4486	2 4574	2 4660	2 4745	2 4829	2 4908	2 4991	2 5065	14	27	41	45	63
	20	.4540	.4628	.4714	.4799	.4883	.4952	.5045	.5119				50	70
	40	.4593	.4682	.4768	.4857	.4936	.5005	.5098	.5172				55	77
27	0	.4648	.4736	.4823	.4905	.4988	.5069	.5148	.5223					
	20	.4701	.4789	.4876	.4957	.5041	.5122	.5200	.5275					
	40	.4753	.4841	.4928	.5009	.5093	.5173	.5251	.5327				5	7
28	0	.4802	.4890	.4975	.5060	.5143	.5223	.5302	.5381				10	14
	20	.4851	.4939	.5024	.5109	.5192	.5272	.5351	.5430				15	21
	40	.4900	.4988	.5073	.5158	.5240	.5320	.5399	.5478				20	28
29	0	.4949	.5036	.5124	.5208	.5288	.5368	.5449	.5527	13	25	38	25	35
	20	.4997	.5084	.5172	.5256	.5336	.5416	.5497	.5575				30	42
	40	.5044	.5132	.5229	.5303	.5383	.5463	.5544	.5622				35	49
30	0	.5092	.5180	.5266	.5348	.5428	.5510	.5589	.5667				40	56
	20	.5138	.5226	.5312	.5394	.5474	.5556	.5635	.5713				45	63
	40	.5184	.5271	.5357	.5439	.5519	5601	.5680	.5757				50	70
31	0	.5230	.5315	.5400	.5484	.5564	.5645	.5723	.5802				55	77
	20	.5274	.5359	.5444	.5528	.5607	.5688	.5766	.5845					
	40	.5317	.5402	.5487	.5570	.5651	.5731	.5819	.5887	11	21	32	5	7
32	0	.5358	.5444	.5528	.5611	.5693	.5764	.5852	.5927				10	13
	20	.5401	.5487	.5571	.5654	.5736	.5807	.5895	.5970				15	20
	40	.5443	.5529	.5613	.5696	.5778	.5848	.5937	.6010				20	28
33	0	.5484	.5569	.5654	.5738	.5818	.5897	.5977	.6049				25	34
	20	.5526	.5611	.5696	.5779	.5859	.5938	.6018	.6089				30	40
	40	.5567	.5652	.5735	.5818	.5899	.5978	.6058	.6129	10	20	30	35	46
34	0	.5605	.5689	.5774	.5857	.5940	.6017	.6098	.6170				40	53
	20	.5645	.5729	.5814	.5896	.5979	.6056	.6138	.6210				45	60
	40	.5684	.5768	.5852	.5934	.6028	.6095	.6177	.6259				50	66
35	0	.5722	.5807	.5891	.5971	.6057	.6133	.6216	.6289				55	73
	20	.5760	.5845	.5929	.6019	.6093	.6171	.6254	.6327					
	40	.5797	.5882	.5966	.6056	.6129	.6208	.6289	.6363					
36	0	.5832	.5917	.6002	.6083	.6164	.6244	.6323	.6398				5	7
	20	.5868	.5954	.6038	.6119	.6200	.6280	.6359	.6434	9	18	27	10	13
	40	.5903	.5990	.6074	.6156	.6235	.6315	.6394	.6470				15	20
37	0	.5938	.6027	.6109	.6192	.6270	.6350	.6429	.6506				20	27
	20	.5973	.6060	.6144	.6227	.6305	.6394	.6463	.6540				25	34
	40	.6018	.6093	.6178	.6261	.6340	.6427	.6507	.6573				30	40
38	0	.6043	.6126	.6211	.6293	.6374	.6450	.6531	.6606				35	46
	20	.6077	.6160	.6245	.6327	.6407	.6485	.6564	.6639				40	53
	40	.6109	.6193	.6278	.6360	.6440	.6529	.6596	.6673				45	60
39	0	.6141	.6227	.6311	.6392	.6473	.6553	.6629	.6707				50	66
	20	.6174	.6260	.6344	.6425	.6506	.6586	.6662	.6740				55	73
	40	.6205	.6290	.6374	.6456	.6538	.6616	.6692	.6770					
40	0	.6238	.6323	.6405	.6488	.6570	.6647	.6723	.6801	8	16	24		
	20	.6270	.6355	.6437	.6520	.6602	.6679	.6755	.6833					
	40	.6300	.6386	.6468	.6550	.6631	.6709	.6786	.6864					

TABLE I. *Argument Moon's Apparent Altitude & Hor. Pax.* — *Dif. in Alt.* — HP.

MOON'S ALT.		54′	55′	56′	57′	58′	59′	60′	61′	5′	10′	15′
41	0	2 6330	2 6416	2 6498	2 6580	2 6661	2 6739	2 6817	2 6894			
	20	.6361	.6447	.6539	.6611	.6692	.6770	.6848	.6925			
	40	.6390	.6476	.6568	.6640	.6721	.6799	.6877	.6953			
42	0	.6419	.6505	.6588	.6669	.6749	.6826	.6905	.6982			
	20	.6449	.6535	.6618	.6699	.6779	.6856	.6935	·7012			
	40	.6478	.6563	.6646	.6727	.6808	.6885	.6964	·7040			
43	0	.6504	.6590	.6673	.6754	.6835	.6913	.6991	·7067	7	15	22
	20	.6533	.6619	.6702	.6783	.6864	.6942	·7020	·7096			
	40	.6562	.6647	.6729	.6813	.6891	.6970	·7048	·7124			
44	0	.6590	.6674	.6756	.6838	.6917	.6996	·7075	·7151			
	20	.6618	.6702	.6784	.6866	.6945	·7023	·7102	·7179			
	40	.6644	.6728	.6811	.6893	.6972	·7049	·7128	·7205			
45	0	.6669	.6754	.6838	.6917	.6999	·7077	·7155	·7230			
	20	.6697	.6781	.6865	.6940	·7026	·7104	·7182	·7257			
	40	.6721	.6806	.6891	.6968	·7051	·7129	·7207	·7282			
46	0	.6745	.6830	.6914	.6996	·7074	·7153	·7231	·7305			
	20	.6770	.6855	.6939	·7021	·7099	·7178	·7256	·7330	6	12	18
	40	.6795	.6880	.6964	·7045	·7124	·7203	·7280	·7356			
47	0	.6819	.6904	.6987	·7069	·7148	·7227	·7305	·7381	6	13	19
	20	.6844	.6929	·7012	·7094	·7173	·7252	·7330	·7406			
	40	.6869	.6954	·7036	·7118	·7197	·7276	·7354	·7430			
48	0	.6894	,6979	·7060	·7142	·7221	·7298	·7377	·7453	6	12	18
	20	.6918	·7003	·7084	·7164	·7245	·7322	·7401	·7477			
	40	.6941	·7026	·7108	·7188	·7269	·7346	·7423	·7500			
49	0	.6963	·7048	·7131	·7212	·7292	·7370	·7445	·7522			
	20	.6985	·7070	·7153	·7235	·7315	·7392	·7467	·7544	5	11	17
	40	·7007	·7092	·7175	·7257	·7337	·7414	·7489	·7566			
50	0	·7030	·7116	·7197	·7279	·7358	·7435	·7511	·7588			
	20	·7052	·7138	·7219	·7300	·7380	·7457	·7533	·7610			
	40	·7074	·7160	·7241	·7321	·7402	·7479	·7555	·7632			
51	0	·7095	·7180	·7263	·7342	·7423	·7501	·7578	·7653			
	20	·7116	·7201	·7284	·7363	·7444	·7522	·7599	·7674	5	10	15
	40	·7137	·7221	·7304	·7384	·7464	·7542	·7619	·7694			
52	0	·7157	·7240	·7233	·7404	·7484	·7562	·7639	·7714			
	20	·7177	·7260	·7343	·7425	·7505	·7582	·7659	·7735			
	40	·7197	·7281	·7363	·7445	·7525	·7602	·7679	·7755			
53	0	·7217	·7301	·7383	·7466	·7545	·7622	·7699	·7775			
	20	·7237	·7321	·7403	·7485	·7564	·7642	·7720	·7795			
	40	·7256	·7342	·7423	·7504	·7583	·7661	·7739	·7814			
54	0	·7275	·7363	·7443	·7523	·7602	·7681	·7758	·7833	5	9	14
	20	·7294	·7382	·7461	·7541	·7620	·7700	·7776	·7850			
	40	·7313	·7400	·7480	·7560	·7639	·7717	·7794	·7866			
55	0	·7332	·7415	·7499	·7579	·7657	·7733	·7812	·7888			
	20	·7350	·7433	·7517	·7596	·7675	·7751	·7831	·7906			
	40	·7368	·7451	·7535	·7614	·7693	·7770	·7850	·7924			
56	0	·7385	·7469	·7553	·7632	·7712	·7789	·7868	·7941			
	20	·7403	·7487	·7571	·7650	·7730	·7807	·7886	·7959			
	40	·7420	·7504	·7587	·7667	·7747	·7824	·7903	·7973			
57	0	·7437	·7520	·7603	·7684	·7762	·7840	·7918	·7991			
	20	·7453	·7536	·7620	·7701	·7779	·7857	·7935	.8008	4	9	13
	40	·7469	·7552	·7637	·7717	·7796	·7874	·7951	.8025			
58	0	·7486	·7570	·7653	·7733	·7814	·7890	·7966	.8041			
	20	·7502	·7586	·7669	·7749	·7830	·7906	·7982	.8057			
	40	·7518	·7602	·7685	·7765	7846	·7923	·7998	.8074			

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TABLE I. *Argument Moon's Apparent Altitude & Hor. Pax.*

MOON's ALT.										*Dif. in Alt.*			HP.	
		54′	55′	56′	57′	58′	59′	60′	61′	5′	10′	15′	″	
59	0	2 7533	2 7617	2 7699	2 7781	2 7860	2 7939	2 8015	2 8090					
	20	.7549	.7633	.7715	.7797	.7876	.7955	.8031	.8106					
	40	.7565	.7649	.7731	.7813	.7892	.7970	.8046	.8120	4	8	12	5	6
60	0	.7580	.7663	.7746	.7826	.7906	.7983	.8060	.8134				10	12
	20	.7595	.7678	.7761	.7841	.7921	.7998	.8075	.8149				15	19
	40	.7609	.7693	.7775	.7855	.7935	.8012	.8090	.8164				20	26
61	0	.7623	.7708	.7789	.7870	7948	.8026	.8104	.8180				25	33
	20	.7638	.7723	.7804	.7885	.7963	.8040	.8118	.8194				30	39
	40	.7653	.7737	.7818	.7899	.7977	.8054	.8132	.8208				35	46
62	0	.7667	.7751	.7832	.7912	.7990	.8068	.8146	.8221	4	7	11	40	52
	20	.7681	.7765	.7846	.7926	.8004	.8082	.8160	.8235				45	59
	40	.7695	.7778	.7860	.7940	.8019	.8096	.8173	.8249				50	65
63	0	.7709	.7792	.7873	.7953	.8033	.8111	.8186	.8263				55	71
	20	.7722	.7805	.7886	.7966	.8046	.8124	.8199	.8277					
	40	.7734	.7818	.7899	.7979	.8059	.8137	.8213	.8290				5	6
64	0	.7745	.7830	.7912	.7991	.8073	.8150	.8226	.8302				10	12
	20	.7758	.7843	.7925	.8004	.8086	.8163	.8239	.8315				15	19
	40	.7771	.7856	.7937	.8017	.8098	.8176	.8251	.8326	3	6	10	20	26
65	0	.7784	.7868	.7948	.8030	.8108	.8188	.8263	.8337				25	33
	20	.7796	.7880	.7960	.8042	.8120	.8200	.8275	.8349				30	39
	40	.7807	.7892	.7972	.8055	.8132	.8210	.8286	.8360				35	46
66	0	.7818	.7904	.7984	.8067	.8144	.8220	.8297	.8372				40	52
	20	.7831	.7915	.7996	.8078	.8156	.8232	.8309	.8383				45	59
	40	.7843	.7926	.8008	.8089	.8167	.8243	.8320	.8395				50	65
67	0	.7855	.7937	.8020	.8099	.8179	.8255	.8331	.8407	3	5	9	55	71
	20	.7866	.7948	.8031	.8110	.8190	.8266	.8342	.8418	3	5	8		
	40	.7877	.7958	.8042	.8120	.8200	.8276	.8354	.8429					
68	0	.7887	.7969	.8052	.8130	.8211	.8287	.8366	.8439				5	6
	20	.7899	.7980	.8063	.8140	.8221	.8298	.8375	.8449				10	12
	40	.7911	.7991	.8072	.8151	.8231	.8309	.8384	.8460				15	19
69	0	.7923	.8002	.8081	.8162	.8241	.8320	.8394	.8471				20	26
	20	.7932	.8012	.8092	.8172	.8251	.8330	.8404	.8481				25	33
	40	.7940	.8021	.8103	.8181	.8262	.8339	.8415	.8490				30	39
70	0	.7948	.8030	.8114	.8191	.8272	.8347	.8426	.8499				35	46
	20	.7957	,8040	.8122	.8200	.8280	.8357	.8434	.8508				40	52
	40	.7965	.8049	.8130	.8210	.8289	.8366	.8442	.8516	2	5	7	45	59
71	0	.7973	.8058	.8138	.8220	.8297	.8376	.8450	.8526				50	65
	0	.7983	.8068	.8148	.8229	.8306	.8384	.8458	.8535				55	71
	40	.7992	.8079	.8157	.8238	.8315	.8392	.8467	.8544					
72	0	.8001	.8081	.8166	.8244	.8324	.8400	.8477	.8553				5	6
	20	.8009	.8089	.8174	.8252	.8332	.8408	.8485	.8561				10	13
	40	.8017	.8097	.8182	.8260	.8340	.8416	.8493	.8570				15	20
73	0	.8025	.8106	.8190	.8270	.8348	.8428	.8501	.8578				20	26
	20	.8033	.8112	.8197	.8274	.8355	.8436	.8509	.8586				25	33
	40	.8041	8120	.8205	.8282	.8363	.8444	.8517	.8594	2	4	6	30	40
74	0	.8049	.8128	.8213	.8290	.8371	.8452	.8525	.8602				35	47
	20	.8056	.8137	.8220	.8299	.8380	.8458	.8533	.8609				40	53
	40	.8062	.8145	.8226	.8307	.8388	.8464	.8541	.8616				45	59
75	0	.8068	.8153	.8232	.8315	.8396	.8470	.8548	.8621				50	65
	20	.8076	.8159	.8240	.8321	.8402	.8477	.8555	.8627				55	72
	40	.8083	.8165	.8248	.8326	.8408	.8483	.8561	.8633					
76	0	.8090	.8171	.8256	.8332	.8414	.8489	.8567	.8639					
	20	.8098	.8178	.8263	.8339	.8421	.8496	.8574	.8646					
	40	.8105	.8184	.8270	.8346	.8428	.8502	.8581	.8653					

TABLE I. *Argument Moon's Apparent Altitude & Hor. Pax.* | *Dif. in Alt.* | HP

MOON'S ALT.		54′	55′	56′	57′	58′	59″	60′	61′	5′	10′	15′
77	0	2 8112	2 8190	2 .8276	2 8352	2 8435	2 8508	2 8588	2 8659			
	20	.8118	.8196	.8282	.8358	.8440	.8515	.8592	.8665			
	40	.8123	.8202	.8287	.8364	.8445	.8521	.8596	.8671			
78	0	.8128	.8208	.8293	.8370	.8449	.8527	.8600	.8678			
	20	.8132	.8215	.8297	.8377	.8455	.8531	.8607	.8683			
	40	.8136	.8222	.8301	.8383	.8460	.8535	.8613	.8687			
79	0	.8140	.8228	.8305	.8389	.8465	.8539	.8619	.8691			
	20	.8146	.8232	.8309	.8392	.8470	.8545	.8623	.8695			
	40	.8152	.8235	.8313	.8396	.8476	.8551	.8627	.8699			
80	0	.8157	.8238	.8317	.8400	.8481	.8558	.8631	.8703			
	20	.8162	.8242	.8324	.8405	.8484	.8564	.8635	.8709			
	40	.8166	.8246	.8331	.8410	.8487	.8568	.8640	.8715			
81	0	.8170	.8249	.8337	.8414	.8491	.8572	.8645	.8720	1	2	3
	20	.8174	.8253	.8341	.8417	.8494	.8576	.8648	.8723			
	40	.8178	.8257	.8345	.8421	.8498	.8580	.8651	.8726			
82	0	.8182	.8261	.8349	.8425	.8502	.8584	.8655	.8729			
	20	.8185	.8264	.8351	.8429	.8506	.8587	.8659	.8733			
	40	.8188	.8268	.8352	.8433	.8510	.8590	.8664	.8737			
83	0	.8192	.8272	.8354	.8437	.8514	.8592	.8669	.8741			
	20	.8196	.8275	.8356	.8440	.8518	.8595	.8670	.8743			
	40	.8199	.8278	.8358	.8442	.8521	.8597	.8671	.8746			
84	0	.8203	.8281	.8360	.8444	.8524	.8600	.8672	.8750			
	20	.8205	.8283	.8362	.8446	.8527	.8604	.8675	.8753			
	40	.8207	.8285	.8364	.8448	.8530	.8609	.8678	.8756			
85	0	.8208	.8287	.8366	.8450	.8534	.8614	.8680	.8758			
	20	.8211	.8289	.8368	.8454	.8538	.8618	.8682	.8760			
	40	.8215	.8291	.8370	8457	.8541	.8621	.8684	.8762			
86	0	.8219	.8293	.8372	.8460	.8545	.8624	.8686	.8764			
	20	.8223	.8297	.8375	.8462	.8548	.8628	.8688	.8766			
	40	.8227	.8301	.8378	.8464	.8551	.8631	.8690	.8768			
87	0	.8230	.8304	.8380	.8466	.8554	.8635	.8693	.8770	0	0	3

5	6
10	13
15	19
20	25
25	32
30	39
35	45
40	52
45	58
50	64
55	71
5	7
10	13
15	20
20	26
25	33
30	41
35	47
40	55
45	63
50	70
55	76

If the utmost Accuracy is required, take the Log. No. I. *to Table* IV. *and to its corresponding Number there found, apply the difference in the Supplemental Table with its proper Sign, with which increased or decreased quantity find a New Log. in Tab.* IV. *which will be the true Log. No.* I.

ALT.	Correct. ⊙	Correct. ✳	ALT.	Correct. ⊙	Correct. ✳
5°	+05	+04	30°	+01	—09
6	02	00	33	02	09
7	—00	—02	37	03	09
8	01	03	41	04	09
9	02	04	46	05	09
10	02	05	50	06	09
11	02	06	55	07	09
13	02	07	63	08	09
15	02	08	64	09	09
21	01	08	65	09	09
26	00	09	66	09	09
29	+01	09	69	09	09

TABLE II.

							Difference.								
Degrs.	0′	10′	20′	30′	40′	50′	1′	2′	3′	4′	5′	6″	7′	8′	9′
0	.	.	.	1.6021	1.4560	1.3803									
1	1.3011	1.2341	1.1761	.1154	.0791	.0300	34	68	102	136	170	204	238	272	306
2	0.9929	0.9587	0.9269	0.8974	0.8644	0.8437									
3	.8144	.7914	.7696	.7489	.7329	.7100									
4	.6854	.6744	.6576	.6415	.6321	.6109									
5	.5064	.5823	.5687	.5555	.5402	.5302	13	27	40	53	67	81	94	108	121
6	.5157	.5064	.4949	.4837	.4728	.4601									
7	.4498	.4397	.4299	.4203	.4108	.4016									
8	.3944	.3837	.3751	.3665	.3582	.3517									
9	.3420	.3342	.3264	.3188	.3113	.3040									
10	.2953	.2896	.2826	.2758	.2690	.2623	7	13	20	26	33	39	46	52	59
11	.2558	.2493	.2429	.2366	.2304	.2243									
12	.2195	.2124	.2065	.2007	.1950	.1894									
13	.1835	.1794	.1760	.1686	.1633	.1581									
14	.1529	.1478	.1417	.1377	.1328	.1279									
15	.1231	.1183	.1145	.1089	.1052	.1006	5	9	14	18	23	27	32	36	41
16	.0961	.0916	.0871	.0826	.0783	.0749									
17	.0706	.0664	.0622	.0589	.0649	.0495									
18	.0458	.0426	.0386	.0347	.0316	.0287									
19	.0239	.0200	9.9963	.0125	.0096	.0059	4	8	11	15	19	23	26	3	34
20	.0022	9.9991	.9958	9.9925	9.9890	9.9857	3	7	10	13	16	19	22	27	30
21	9.9825	.9794	.9763	.9732	.9701	.9669									
22	.9638	.9608	.9578	.9548	.9518	.9588									
23	.9458	.9429	.9400	.9371	.9342	.9313									
24	.9285	9258	.9231	.9204	.9177	.9150									
25	.9122	.9096	.9070	.9044	.9018	.8982									
26	.8965	.8940	.8915	.8890	.8865	.8840									
27	.8814	.8790	.8766	.8742	.8718	.8694									
28	.8671	.8648	.8625	.8602	.8579	.8556									
29	.8532	.8510	.8488	.8466	.8444	.8422									
30	.8398	.8377	.8356	.8335	.8314	.8293	2	4	6	8	10	13	15	17	19
31	.8271	.8250	.8229	.8208	.8187	.8166									
32	.8147	.8127	.8107	.8086	.8067	.8047									
33	.8027	.8008	.7989	.7969	.7950	.7930									
34	.7910	.7892	.7874	.7856	.7838	.7820									
35	.7799	.7781	.7763	.7745	.7727	.7709									
36	.7690	.7672	.7654	.7636	.7618	.7600									
37	.7585	.7568	.7551	.7534	.7517	.7500									
38	.7481	.7465	.7449	.7433	.7417	.7401									
39	.7383	.7367	.7351	.7335	.7319	.7303									
40	.7286	.7270	.7254	.7239	.7224	.7209	2	3	5	6	8	10	12	14	15
41	.7194	.7179	.7165	.7151	.7136	.7121									
42	.7106	.7092	.7078	.7064	.7050	.7034									
43	.7022	.7009	.6996	.6983	.6970	.6957									
44	.6942	.6929	.6916	.6903	.6890	.6877									
45	.6863	.6850	.6837	.6824	.6811	.6798									
46	.6788	.6776	.6764	.6752	.6740	.6728									
47	.6716	.6705	.6694	.6683	.6672	.6660									
48	.6647	.6636	.6625	.6614	.6603	.6591									
49	.6578	.6568	.6558	.6548	.6538	.6528									

TABLE II.							Difference.								
Degrs.	0′	10′	20′	30′	40′	50′	1′	2′	3′	4′	5′	6′	7′	8′	9′
50	9.6517	9.6507	9.6497	9.6487	9.6477	9.6467	1	2	3	4	5	6	7	8	9
51	.6455	.6445	.6435	.6425	.6415	.6405									
52	.6396	.6386	.6376	.6366	.6357	.6348									
53	.6340	.6331	.6321	.6311	.6302	.6293									
54	.6284	.6275	.6266	.6257	.6248	.6239									
55	.6231	.6222	.6213	.6204	.6195	.6187									
56	.6178	.6170	.6162	.6154	.6146	.6138									
57	.6128	.6120	.6113	.6106	.6099	.6090									
58	.6080	.6073	.6066	.6058	.6050	.6043									
59	.6035	.6027	.6019	.6011	.6003	·5996									
60	·5989	·5982	·5975	·5968	·5961	·5954	1	2	3	4	5	6	7	8	9
61	·5947	·5940	·5933	·5926	·5919	·5912									
62	·5906	·5900	·5894	·5888	·5882	·5874									
63	·5867	·5861	·5855	·5849	·5843	·5837									
64	·5830	·5824	·5818	·5812	·5806	·5800									
65	·5794	·5788	·5782	·5776	·5770	·5765									
66	·5760	·5755	·5750	·5745	·5740	·5734									
67	·5727	·5722	·5717	·5712	·5707	·5702									
68	·5696	·5691	·5686	·5681	·5676	·5671									
69	·5667	·5661	·5655	·5650	·5644	·5638									
70	·5632	·5626	·5620	·5615	·5610	·5605									
71	·5600	·5595	·5590	·5587	·5582	·5577									
72	·5572	·5568	·5564	·5560	·5556	·5553									
73	·5550	·5547	·5544	·5541	·5538	·5534									
74	·5530	·5527	·5524	·5521	·5518	·5514									
75	·5510	·5507	·5504	·5501	·5498	·5495									
76	·5491	·5488	·5485	·5482	·5479	·5476									
77	·5474	·5472	·5470	·5468	·5465	·5463									
78	·5460	·5458	·5456	·5454	·5451	·5448									
79	·5444	·5441	·5438	·5435	·5433	·5431									
80	·5429	·5427	·5425	·5423	·5420	·5417									
81	·5415	·5413	·5411	·5409	·5407	·5405									
82	·5403	·5401	·5399	·5397	·5396	·5394									
83	·5393	·5391	·5389	·5387	·5385	·5382									
84	·5383	·5381	·5380	·5379	·5378	·5377									
85	·5376	·5375	·5374	·5373	·5372	·5371									
86	·5370	·5369	·5368	·5367	·5367	·5366									
87	·5366	....	·5365	....	·5364	....									
88	·5363	....	....	·5362	....	....									
89	·5361	....	....	....	....	....									
90	·5361	....	....	....	....	....									
91	·5361	....	....	·5362	....	....									
92	·5363	....	·5364	....	·5365	....									
93	·5366	....	·5368	....	....	....									
94	·5370	....	·5373	....	....	....									
95	·5376	....	....	·5379	....	....									
96	·5383	....	....	·5388	....	....									
97	·5393	·5395	·5396	·5396	·5397	·5400									
98	·5403	·5405	·5407	·5409	·5411	·5414									
99	·5415	·5417	·5419	·5421	·5424	·5426									

TABLE II.

							Difference.								
Degrs.	0′	10′	20′	30′	40′	50′	1′	2′	3′	4′	5′	6′	7′	8′	9′
100	·5429	9·5432	9·5435	9·5438	9·5440	9·5442									
101	·5444	·5447	·5450	·5453	·5456	·5458									
102	·5460	·5462	·5465	·5468	·5470	·5472									
103	·5474	·5477	·5480	·5483	·5486	·5488									
104	·5491	·5494	·5497	·5500	·5503	·5506									
105	·5510	·5514	·5517	·5520	·5523	·5527									
106	·5530	·5534	·5537	·5540	·5543	·5547									
107	·5550	·5554	·5557	·5561	·5564	·5568									
108	·5572	·5577	·5582	·5586	·5590	·5595									
109	·5600	·5605	·5610	·5615	·5620	·5626									
110	9·5632	·5638	·5644	·5650	·5655	·5661									
111	·5667	·5671	·5676	·5681	·5686	·5691									
112	·5696	·5702	·5707	·5712	·5717	·5722									
113	·5727	·5734	·5740	·5745	·5750	·5755									
114	·5760	·5765	·5770	·5776	·5782	·5788									
115	5794	·5800	·5806	·5812	·5818	·5824									
116	·5830	·5837	·5843	·5849	·5855	·5861									
117	·5867	·5874	·5882	·5888	·5894	·5900									
118	·5906	·5912	·5919	·5926	·5933	·5940									
119	·5947	·5954	·5961	·5968	·5975	·5982									
120	·5989	·5996	.6003	.6011	.6015	.6027	1	2	3	3	4	4	5	5	6

TABLE III. Part I.

°	′	No.	°	No.	°	No.	°	No.	°	No.	°	No.	°	No.
0	0	1000	14	970	33	839	52	616	70	342	88	35	106	276
2	30	999	15	966	34	829	53	602	71	326	89	17	107	292
3	30	998	16	961	35	819	54	588	72	309	90	0	108	309
4	30	997	17	956	36	809	55	574	73	292	91	17	109	326
5	10	996	18	951	37	799	56	559	74	276	92	35	110	342
5	45	995	19	946	38	788	57	545	75	259	93	52	111	358
6	20	994	20	940	39	777	58	530	76	242	94	70	112	375
6	50	993	21	934	40	766	59	515	77	225	95	87	113	391
7	15	992	22	927	41	755	60	500	78	208	96	105	114	407
7	35	991	23	921	42	743	61	485	79	191	97	122	115	423
8	0	990	24	914	43	731	62	469	80	174	98	139	116	438
8	35	989	25	906	44	719	63	454	81	156	99	156	117	454
9	0	988	26	899	45	707	64	438	82	139	100	174	118	469
9	15	987	27	891	46	695	65	423	83	122	101	191	119	485
9	35	986	28	883	47	682	66	407	84	105	102	208	120	500
10	0	985	29	874	48	669	67	391	85	87	103	225	121	515
11	0	982	30	866	49	656	68	375	86	70	104	242	122	530
12	0	978	31	857	50	643	69	358	87	52	105	259	123	545
13	0	974	32	848	51	629								

TABLE III. PART II.

No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.
10	8 .3645	57	9 .1192	104	9 .3810	151	9 .5421	198	9 .6596
11	.4056	58	.1250	105	.3851	152	.5452	199	.6615
12	.4437	59	.1308	106	.3893	153	.5482	200	.6635
13	.4763	60	.1427	107	.3936	154	.5513	201	.6655
14	.5100	61	.1487	108	.3980	155	.5544	202	.6676
15	.5391	62	.1550	109	.4023	156	.5560	203	.6716
16	.5670	63	.1612	110	.4056	157	.5591	204	.6737
17	.5952	64	.1675	111	.4101	158	.5622	205	.6757
18	.6179	65	.1740	112	.4134	159	.5654	206	.6778
19	.6421	66	.1805	113	.4170	160	.5680	207	.6799
20	.6635	67	.1871	114	.4214	161	.5712	208	.6819
21	.6861	68	.1938	115	.4248	162	.5735	209	.6839
22	.7055	69	.2007	116	.4295	163	.5751	210	.6861
23	.7258	70	.2076	117	.4329	164	.5784	211	.6882
24	.7423	71	.2147	118	.4365	165	.5827	212	.6904
25	.7620	72	.2218	119	.4401	166	.5846	213	.6925
26	.7773	73	.2291	120	.4437	167	.5867	214	.6940
27	.7932	74	.2330	121	.4473	168	.5884	215	.6954
28	.8097	75	.2366	122	.4498	169	.5918	216	.6972
29	.8240	76	.2441	123	.4547	170	.5952	217	.6991
30	.8386	77	.2518	124	.4572	171	.5969	218	.7011
31	.8539	78	.2557	125	.4600	172	.5986	219	.7030
32	.8665	79	.2596	126	.4647	173	.6021	220	.7050
33	.8794	80	.2676	127	.4685	174	.6038	221	.7070
34	.8928	81	.2716	128	.4711	175	.6055	222	.7090
35	.9066	82	.2757	129	.4749	176	.6091	223	.7111
36	.9172	83	.2840	130	.4776	177	.6108	224	.7134
37	.9318	84	.2882	131	.4815	178	.6144	225	.7150
38	.9431	85	.2924	132	.4841	179	.6162	226	.7170
39	.9547	86	.3010	133	.4882	180	.6180	227	.7190
40	.9666	87	.3054	134	.4908	181	.6216	228	.7212
41	.9747	88	.3098	135	.4935	182	.6234	229	.7230
42	.9872	89	.3145	136	.4976	183	.6253	230	.7250
43	.9957	90	.3188	137	.5017	184	.6289	231	.7268
44	9 .0044	91	.3234	138	.5031	185	.6308	232	.7282
45	.0177	92	.3280	139	.5072	186	.6326	233	.7300
46	.0269	93	.3326	140	.5100	187	.6345	234	.7318
47	.0362	94	.3372	141	.5129	188	.6383	235	.7336
48	.0458	95	.3420	142	.5157	189	.6402	236	.7349
49	.0506	96	.3468	143	.5186	190	.6421	237	.7369
50	.0605	97	.3516	144	.5215	191	.6430	238	.7389
51	.0706	98	.3565	145	.5243	192	.6459	239	.7410
52	.0810	99	.3605	146	.5272	193	.6478	240	.7430
53	.0862	100	.3645	147	.5302	194	.6517	241	.7451
54	.0970	101	.3686	148	.5331	195	.6536	242	.7472
55	.1034	102	.3726	149	.5361	196	.6556	243	.7496
56	.1135	103	.3778	150	.5391	197	.6576		

TABLE IV. *Argument Correct. of Diff. of Apparent Altitudes.*

	0	1	2	3	4	5	6	7	8	9	
	0	6″	12″	18″	24″	30″	36″	42″	48″	54″	
′	0	0.″6	1.″2	1.″8	2.″4	3.″0	3.″6	4.″2	4.″8	5.″4	′ ″
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	1 0
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	6
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	12
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	18
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	24
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	30
16	2041	2068	2095	2122	2149	2175	2201	2227	2253	2279	36
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	42
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	48
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	54
20	3010	3032	3954	3075	3096	3118	3139	3160	3181	3201	2 0
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	6
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	12
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	18
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	24
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4132	30
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	36
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	42
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	48
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	54
30	4771	4785	4800	4814	4829	4843	4857	4871	4886	4900	3 0
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	6
32	5052	5065	5079	5092	5005	5119	5132	5145	5159	5172	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	18
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	24
35	5441	5453	5465	5478	5490	5502	5515	5527	5539	5551	30
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	36
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	42
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	48
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	54
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	4 0
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	6
42	6238	6243	6253	6263	6274	6284	6294	6304	6314	6325	12
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	18
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	24
45	6532	6542	6552	6561	6571	6580	6590	6599	6609	6618	30
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	36
47	6721	6730	6739	6749	6758	6766	6776	6785	6794	6803	42
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	48
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	54

TABLE IV. *Argument Correct. of Diff. of Apparent Altitudes.*

	0	1	2	3	4	5	6	7	8	9	
	0	6″	12″	18″	24″	30″	36″	42″	48″	54″	
′	0	0.″6	1.″2	1.″8	2.″4	3.″0	3.″6	4.″2	4.″8	5.″4	′ ″
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	5 0
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	6
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	12
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	18
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	24
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	30
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	36
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	42
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	48
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	54
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	6 0
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	12
63	7993	8000	8007	8014	8021	8028	8035	8042	8048	8055	18
64	8062	8069	8075	8082	8089	8096	8102	8109	8115	8122	24
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	30
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	36
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	42
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	48
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	54
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	7 0
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	6
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	12
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	18
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	24
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	30
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	36
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	42
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	48
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	54
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	8 0
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	6
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	12
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	18
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9286	24
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	30
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	36
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	42
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	48
89	9494	9499	9504	9509	9513	9518	9528	9528	9533	9538	54

TABLE IV. *Argument Correct. of Diff. of Apparent Altitudes.*

	0	1	2	3	4	5	6	7	8	9	
	0	6"	12"	18"	24"	30"	36"	42"	48'	54"	
'	0	0."6	1."2	1."8	2."4	3."0	3."6	4."2	4."8	5."4	' "
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	9 0
91	9590	9595	9600	9605	9609	9614	9619	9624	9629	9633	6
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9681	12
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	18
94	9731	9736	9741	9745	9750	9754	9759	9764	9768	9773	24
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	30
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	36
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	42
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	48
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	54
100	0000	0004	0009	0013	0017	0022	0026	0030	0035	0039	10 0
101	0043	0048	0052	0056	0060	0065	0069	0073	0077	0082	6
102	0086	0090	0095	0099	0103	0107	0111	0116	0120	0124	12
103	0128	0133	0137	0141	0145	0149	0153	0158	0162	0166	18
104	0170	0175	0179	0183	0187	0191	0195	0199	0203	0208	24
105	0212	0216	0220	0224	0228	0233	0237	0241	0245	0249	30
106	0253	0257	0261	0265	0269	0273	0278	0282	0286	0290	36
107	0294	0298	0302	0306	0310	0314	0318	0322	0326	0330	42
108	0334	0338	0342	0346	0350	0354	0358	0362	0366	0370	48
109	0374	0378	0382	0386	0390	0394	0398	0402	0406	0410	54
110	0414	0418	0422	0426	0430	0434	0438	0441	0445	0449	11 0
111	0453	0457	0461	0465	0469	0473	0477	0481	0484	0488	6
112	0492	0496	0500	0504	0508	0512	0515	0519	0523	0527	12
113	0531	0535	0538	0542	0546	0550	0554	0558	0561	0565	18
114	0569	0573	0577	0580	0584	0588	0592	0596	0599	0603	24
115	0607	0611	0615	0618	0622	0626	0630	0633	0637	0641	30
116	0645	0648	0652	0656	0660	0663	0667	0671	0674	0678	36
117	0682	0686	0689	0693	0697	0700	0704	0708	0711	0715	42
118	0719	0722	0726	0730	0734	0737	0741	0745	0748	0752	48
119	0755	0759	0763	0766	0770	0774	0777	0781	0785	0788	54
120	0792	0795	0799	0803	0806	0810	0813	0817	0821	0824	12 0
121	0828	0831	0835	0839	0842	0846	0849	0853	0856	0860	6
122	0864	0867	0871	0874	0878	0881	0885	0888	0892	0896	12
123	0899	0903	0906	0910	0913	0917	0920	0924	0827	0931	18
124	0934	0938	0941	0945	0948	0952	0955	0959	0962	0966	24
125	0969	0973	0976	0980	0983	0986	0990	0993	0997	1000	30
126	1004	1007	1011	1014	1017	1020	1024	1028	1031	1035	36
127	1038	1041	1045	1048	1052	1055	1059	1062	1065	1069	42
128	1072	1075	1079	1082	1086	1089	1092	1096	1099	1103	48
129	1106	1109	1113	1116	1119	1123	1126	1129	1133	1136	54
130	1139	1143	1146	1149	1153	1156	1159	1163	1166	1169	13 0
131	1173	1176	1179	1183	1186	1189	1193	1196	1199	1202	6
132	1206	1209	1212	1216	1219	1222	1225	1229	1232	1235	12
133	1239	1242	1245	1248	1252	1255	1258	1261	1265	1268	18
134	1271	1274	1278	1281	1284	1287	1290	1294	1297	1300	24

TABLE IV. *Argument Correct. of Diff. of Apparent Altitude*

	0	1	2	3	4	5	6	7	8	9	
	0	″	12″	18	24″	30″	36″	42″	48″	54″	
′	0	0.″6	1.″2	1.″8	2.″4	3.″0	3.″6	4.″2	4.″8	5.″4	′ ″
135	1303	1307	1310	1313	1316	1319	1323	1326	1329	1332	30
136	1335	1339	1342	1345	1348	1351	1355	1358	1361	1364	36
137	1367	1370	1374	1377	1380	1383	1386	1389	1392	1396	42
138	1399	1402	1405	1408	1411	1414	1418	1421	1424	1427	48
139	1430	1433	1436	1440	1443	1446	1449	1452	1455	1458	54
140	1461	1464	1467	1471	1474	1477	1480	1483	1486	1489	14 0
141	1492	1495	1498	1501	1504	1508	1511	1514	1517	1520	6
142	1523	1526	1529	1532	1535	1538	1541	1544	1547	1550	12
143	1553	1556	1559	1562	1565	1569	1572	1575	1578	1581	18
144	1584	1587	1590	1593	1596	1599	1602	1605	1608	1611	24
145	1614	1617	1620	1623	1626	1629	1632	1635	1638	1641	30
146	1644	1647	1650	1652	1655	1658	1661	1664	1667	1670	36
147	1673	1676	1679	1682	1685	1688	1691	1694	1697	1700	42
148	1703	1706	1709	1711	1714	1717	1720	1723	1726	1729	48
149	1732	1735	1738	1741	1744	1746	1749	1752	1755	1758	54
150	1761	1764	1767	1770	1773	1775	1778	1781	1784	1787	15 0
151	1790	1793	1796	1798	1801	1804	1807	1810	1813	1816	6
152	1818	1821	1824	1827	1830	1833	1836	1838	1841	1844	12
153	1847	1849	1853	1855	1858	1861	1864	1867	1870	1872	18
154	1875	1878	1881	1884	1887	1889	1892	1895	1898	1901	24
155	1903	1906	1909	1912	1915	1917	1920	1923	1926	1929	30
156	1931	1934	1937	1940	1942	1945	1948	1951	1954	1956	36
157	1959	1962	1965	1967	1970	1973	1976	1978	1981	1984	42
158	1987	1989	1992	1995	1998	2000	2003	2006	2009	2011	48
159	2014	2017	2019	2022	2025	2028	2030	2033	2036	2039	54
160	2041	2044	2047	2049	2052	2055	2058	2068	2063	2066	16 0
161	2068	2071	2074	2076	2079	2082	2084	2087	2090	2093	6
162	2095	2098	2101	2103	2106	2109	2111	2114	2117	2119	12
163	2122	2125	2127	2130	2133	2135	2138	2141	2143	2146	18
164	2148	2151	2154	2156	2159	2162	2164	2167	2170	2172	24
165	2175	2178	2180	2183	2185	2188	2191	2193	2196	2199	30
166	2201	2204	2206	2209	2212	2214	2217	2219	2222	2225	36
167	2227	2230	2232	2235	2238	2240	2243	2245	2248	2251	42
168	2253	2256	2258	2261	2263	2266	2269	2271	2274	2276	48
169	2279	2281	2284	2287	2289	2292	2294	2297	2299	2302	54
170	2305	2307	2310	2312	2315	2317	2320	2322	2325	2327	17 0
171	2330	2333	2335	2338	2340	2343	2345	2348	2350	2353	6
172	2355	2358	2360	2363	2365	2368	2370	2373	2375	2378	12
173	2381	2383	2386	2388	2391	2393	2396	2398	2401	2403	18
174	2406	2408	2411	2413	2416	2418	2420	2423	2425	2428	24
175	2430	2433	2435	2438	2440	2443	2445	2448	2450	2453	30
176	2455	2458	2460	2463	2465	2467	2470	2472	2475	2477	36
177	2480	2482	2485	2487	2490	2492	2494	2497	2499	2502	42
178	2504	2507	2509	2512	2514	2516	2519	2521	2524	2526	48
179	2529	2531	2533	2536	2538	2541	2543	2546	2548	2550	54

PRECEPTS FOR THE USE OF THE TABLES.

I. ENTER Table I. with the degrees of the moon's altitude in the left hand side Column, and with the 20′ of altitude next less than the given, take the Logarithm with the Index which stands under the minutes of the moon's horizontal parallax, place this in the prepared Column No. 1, but in nice cases let the Logarithm be first corrected by the difference from the right hand Columns for the odd minutes of altitude, and for the odd seconds of horizontal parallax.

II. Enter Table II. with the degrees of the sun and moon's apparent distance in the side Column, and take out the Logarithm which stands under the next 10′ less than the given minutes, and correct it by the difference for the odd minutes of distance from the right hand Columns, place this Logarithm in the prepared Columns, No. 2, and 2.

III. Enter Table III. Part I. with the degrees of apparent distance, also with the degrees of apparent difference of altitudes; when the distance is less than 90° the two numbers which are there found are to be subtracted, but added together when more than 90°, the difference or sum is to be carried to the Column No. in Part II. and therewith take out the Log, which place in the prepared Column No. 3.

IV. Enter Table II. with the degrees and minutes called argument 4th. and take the Logarithm, correcting it by the difference for the odd minutes, and place the co-arith of the Index and Log in No. 4.

V. Enter Tab. IV. with the minutes and seconds of the sum of corrections of apparent altitudes, with this consideration that when the minutes are 18 or less, they are found with every 6″ in the right hand Column with odd seconds and tenths in the lower head line of the Table, but when more than 18 the minutes are to be found in the left hand Column; and the nearest 6″ in the second line of the head, the Logarithm in this manner taken out must have an Index 0. if under 10, or 1 if above 9; place the Log with its Index in No. 5.

VII.

VI. Add the three Logarithms in both Columns and with them take the minutes and seconds from Table IV. with the same consideration in respect to the Index as before these will be the two corrections of distance.

VII. If the difference of apparent altitudes is grerter than Argument 4th, both corrections must be substracted from the apparent distance.

VIII. If the differenee of apparent altitudes is less than Argument 4th. the first correction is to be subtracted from and the the second correction added to the apparent distance,

IX. Seek for the true distance amongst the distances of the Sun and Stars from the Moon on the given month and day in the nautical almanack, and write out the two nearest with their respective hours and subtract them, also take the difference of the first distance taken out, and the true distance.

X. With the minutes and seconds of the first remainder take out the complement of its Log from Table IV. under which place the Log, for the minutes and seconds of the second remainder and the constant Log 2.2553, add the three Logarithms together and take the minutes and seconds agreeing therewith, from Table IV. which is to be added to the hours taken out with the first distance, the sum will be the true Greenwich time of Observation.

XI. Compute the ship's time from the sun's altitude used in finding the true distance by help of the Latitude and sun's declination, and write this time beneath the Greenwich time. Subtract the earliest from the latest, the difference will be the Longitude from Greenwich in time which multiplied by 15 will be the degrees minutes &c.

XII. If the time at Greenwich is earliest the Longitude is east, but when the Greenwich time is latest it is west.

The correction found by the first sett of Tables never differs a whole minute from the result by the Tables to four places, and therefore the first four pages are sufficient at all times to determine the Longitude within thirty miles.

EXAMPLES.

EXAMPLE, I.

1794. February 15th. In the Harbour of North Bergen in Norway, at 11ʰ 17′ 18″ Apparent time.

Star's App. Alt.	53°	42′	12″	—	0′	43″	App. Dist. 49° 3′ 55″	HP = 54′ 10″
Moon's App. Alt.	35	47	29	+	42	40		
Diff. App. Alt.	17	54	43		43	23		
	—	21	42					
					21	42		
Argument 4th.	17	33	1					

By the first sett of Tables.

1	2.57	4	9.94		
2	9.66	2	9.66		
3	8.82	5	1.64		
	1.05		1.24	=	17′ 30″—
					11 18—
					28 48

By the second sett to four places.

1	2.5814	4	9.9397		
2	9.6591	2	9.6591		
3	8.8386	5	1.6373		
	1.0791		1.2361	=	17′ 14″—
					12 0—
					29 14—

But if it be thought necessary to correct the first Logarithm; 2.5814 in Table IV. gives 3814, and with the Star's Altitude 54° in the supplement to Table I. take —09 and because it has the negative sign it must be subtracted from 3814, the remainder 3805 in the same Table gives 2.5803 the true Logarithm No. 1.

This Logarithm is less than the former by 11, and consequently the total 1.0791 should be 1.0780, which in Table IV. is 11′ 58″ and therefore the whole correction will be 29′ 12″, this subtracted from the Apparent Distance, gives the true distance, 48° 34′ 43″.

The true Distance computed by spherical trigonometry is 48° 34′ 48″

Then in the nautical almanack the two nearest distances are

IX hours	47° 40′ 13″	47° 40′ 13″
XII hours	49 6 56	48 34 43
	1 26 43	0 54 30

86 43 = 8.0620
54 30 = 1.7364
Constant Log 2.2553

1h 53′ 10″=113′ 10″ = 2.0537
9

Greenwich time 10 53 10
Ship's time 11 17 18

Longitude 0 24 8 = 6° 2′ E.

EXAMPLE, II.

1796. March, 13th. Near the west end of the Grand Bahama.—Latitude 26° 40′N.

Moon's App. Alt. 72° 27′ 2″ + 17′ 40 App. Dist. 56° 48′ 1″ — HP = 59′ 37″
Sun's App. Alt. 39 43 39 — 1 2

32 43 23 — 18 42
+ 9 21

Argument 4th. 32 52 44

By the first sett of Tables.

1	2.85	4	0. 20
2	9.62	2	9. 62
3	8.81	5	1. 27
	1.28		1. 09 = 12′ 18″ +

19 6 —
6 48 —

By the second sett to four places.

1	2. 8460	4	0 1955
2	9. 6142	2	9 6142
3	8. 8240		1. 2718
	1 2842		1 0815 = 12′ 4″ +

19 15 —
7 11 —
59 48 1

1.8359 = 68′ 32″ 56 40 50
8 0034 = 99 14 VI 55 32 18
2.2553 IX 57 11 32

2.0946 = 124′ 20″ = 2h 4′ 20″
6

Greenwich time 8 4 20
Ship's time 2 46 27

5 17 53 = 79° 28′ 15″ Long. W.

EXAMPLE, III.

1797. January, 31st. In Murray's Anchorage Bermuda, at 3h 17′ 35″ Apparent time.

Moon's App. Alt. 49° 29′ 4″ + 35′ 17″ App. Dist. 41° 50′ 23″ — HP = 55′ 35″
Sun's App. Alt. 21 38 1 — 2 15

27 51 3 37 32
+ 18 46

18 46

Argument 4th 28 9 49

By the first sett of Tables.

1	2.71	4	0.13
2	9.71	2	9.71
3	8.51	5	1.58
	0.93		1.42 = 26′ 36″ +

8 30 —

18 6 +

By the second sett to four places.

1	2.7125	4	0.1349
2	9.7106	2	9.7106
3	8.5100	5	1.5742
	0.9331		1.4197 = 26′ 17″ +

8 34 —

+ 17 43
41 50 23

42 8 6
VI. 41 23 21
IX. 42 48 44

1.6508 = 44′ 45″
8.0686 85 23
2.2553

1.9747 = 1h 34′ 20″
6

Greenwich time 7 34 20
Ship's time 3 17 10

4 17 10 = 64 17 30 W.

EXAMPLE, IV.

1797. Tuesday 31st. January. Another sett of Observations situated as before.

Moon's App. Alt. 44° 12′ 46″ + 38′ 52″ App. Dist. 42° 6′ 48″ − HP = 55′ 35″
Sun's App. Alt. 10 39 16 − 4 50

33 33 30 43 42
+ 22 22

Argument 4th 33 55

By the first sett of Tables.

1	2.68	4	0.21
2	9.71	2	9.71
3	8.30	5	1.64
	0.69		1.56 = 36′ 18″ +

4 57 −
31 21 +

By the second sett to four places.

1	2.6738	4	0.2080
2	9.7073	2	9.707
3	8.3010	5	1.6405
	0.6821		1.5558 = 36′ 0″ +

4 50 −
+ 31 10
42 6 48
42 37 58
VI. 41 23 21
IX. 42 48 44

Constant Log. 2.2553
1.8728 = 74′ 37″
8.0686 = 85 23

157′ 18″ = 2.1967 = 2h 37′ 18″
6

Greenwich time 8 37 18
Ship's time 4 20 39

4 16 39 = 64° 9′ 45″ Longitude W.